

WFPDB: UPGRADING THE CATALOGUE OF WIDE-FIELD PLATE ARCHIVES AND RECENT DEVELOPMENT

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Abstract. We consider the new upgrade of the Catalogue of Wide-Field Plate Archives (CWFPAs, <http://wfpdb.org/catalogue.html>) and its actual version 7.0 (February 2014). The increase of the number of wide-field plate archives and the new information, which has to be included, is the reason for adding new codes for plate archive observatory and storage, in order to constitute the unique archive identifier (see <http://wfpdb.org/data/NotesCat7.txt>). The work on importing the aforementioned catalogue is described, as well as some recent development and features of the Wide-Field Plate Database online access system (WFPDB, <http://www.wfpdb.org/search>).

1. INTRODUCTION

The Wide-Field Plate Database (WFPDB, <http://www.wfpdb.org>, Tsvetkov et al. 1997, Tsvetkov 2006) aims usage of the old astronomical photographic plates. The selection of worthy observations is dependent on the quantity and quality of the available plate metadata. In Fig. 1 the WFPDB meta-model is presented. This article focuses only on development regarding archive descriptions, which are represented in the upper part of the diagram. The first established standards of plate metadata were given in the ReadMe file (<http://cdsarc.u-strasbg.fr/viz-bin/Cat?VI/90>) of the WFPDB (Tsvetkov et al. 1997) which can be found through the Catalog VI/90 Selection Page in the Strasbourg Astronomical Data Center. The WFPDB development has required improvement of the accepted formats as standards for plate/archive description, which one can find in Tsvetkova and Tsvetkov (2013). The increase in number of wide-field plate archives, as well as the new defining information about the archives and their storage put the condition for better archive description in order

to constitute the unique archive identifier. This topic is a subject of the present article.

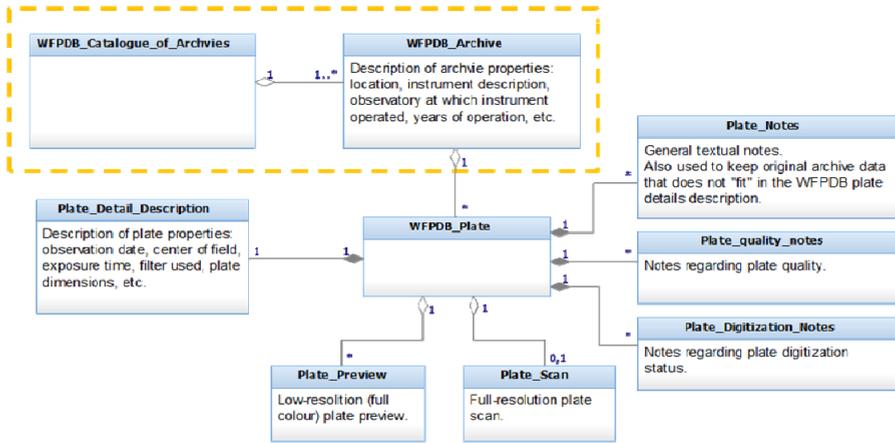


Figure 1: WFPDB meta-model.

2. CATALOGUE OF THE WIDE-FIELD PLATE ARCHIVES

Every wide-field plate archive is considered as a unit in the CWFPA (Tsvetkova and Tsvetkov 2006, 2008) if the astronomical photographic plates, which this archive contains, are:

- obtained by a single instrument (telescope or camera) at a definite location (observatory);
- stored currently at a single location.



Figure 2: Written plate data on the plate emulsion.

From informatics point of view the CWFPA represents description of archive attributes (archive meta-data) in a defined format/schema. In Fig. 2 a sample of plate with hand-written information on the emulsion is presented together with its enlarged part with the text. The text contains data about the plate number, date of observation, object observed, beginning of exposure, exposure duration, and used plate emulsion.

2.1. DATA IN CWFPAs

The upgraded version of the CWFPAs currently contains description of **495** archives from **163** observatories. The catalogue description and its upgraded version from February 2014 are available at <http://www.wfpdb.org/catalogue.html>. The observatory geographical location can be visualized by AstroWeb – an application which presents graphically the data of the CWFPAs version 2011. Fig. 3 presents the map of observatories with plate archives from AstroWeb (<http://wfpdb.org:8000/chameleon/astroweb/astroweb.phtml>). AstroWeb also ensures fast and easy access to the digitalized plate information (Kolev et al. 2012).



Figure 3: Distribution of the observatories possessing plate archives and presented by AstroWeb.

2.2. PLATE ARCHIVE ATTRIBUTES

Byte-by-byte description of the archive attributes in the WFPDB format can be found in Tsvetkova and Tsvetkov (2013). This description includes: WFPDB observatory identifier; Instrument aperture; Suffix to the instrument identifier; Location of the plate archive, town (site); Location of the plate archive, country; Observatory, name; Observatory, site; Observatory, country; Marsden's number; Time zone, sign; Time zone; Observatory longitude, sign; Observatory longitude, deg; Observatory longitude, arcmin; Observatory latitude, sign; Observatory latitude, deg; Observatory latitude, arcmin; Observatory altitude; Multiplicity of telescope cameras; Sign 'x'; Clear aperture of the telescope; Diameter of telescope mirror; Focal length of the telescope; Plate scale; Instrument type; Field angular

dimension; Year of beginning of telescope operation; Year of end of telescope operation; [F] Indication 'F' for 'film'; Number of direct plates; Uncertainty of the number of plates; Plate catalog form (direct plates); Number of objective prism plates; Uncertainty of the number of plates; Plate catalog form (for objective prism plates); Code for archive quality; Astronomer in charge.

2.3. ARCHIVE ATTRIBUTES CHANGES

The WFPDB instrument identifier, which is equal of the archive identifier, is composed by <observatory name><instrument aperture><suffix>, e.g. HAR020A. The number of the wide-field plate archives continues (although slowly) to increase. The information concerning the plate receiving and storage becomes more and more accurate. This is the reason for adding new codes for plate archive observatory and storage. The additional **Archive Code** is needed when some of the plates of one archive are stored in different observatories. The additional **Site Code** is needed when the instrument operated at different locations. These additional codes complement the WFPDB archive identifier on the way to make it a unique archive identifier.

In order to support the WFPDB identifier change, described above, corresponding enhancements have been introduced to the CWFPA. Version 7.0 of the CWFPA contains two additional columns - sub-column "Archive Code" (coded as 1, 2, 3 ...) in column "Location of the Archive" and "Site Code" (coded as a, b, c...) in column "Observatory". The addition of these sub-columns is a result of the need of unique archive identifier in the cases:

- Certain plate archive was made with certain instrument in one observatory, but part of its plates is stored also in another observatory, e.g. the plate archives having Instrument identifier "HAR025" made with 10" Metcalf Triplet of the Harvard Observatory when the telescope was located in Harvard–Boyden Station, South Africa (Observatory code: 74) and now stored as separated archives in Cambridge (USA) are mentioned with archive code (1), Sonneberg (Germany) - mentioned with archive code (2), in Hamburg (Germany) - with archive code (3), and Bamberg (Germany) - with archive code (4);
- Certain plate archive was made with certain instrument moved during the certain time period in another observatory, e.g. the plate archives having Instrument identifier "HAR025" made with 10" Metcalf Triplet of the Harvard Observatory are coded with Site Code "a" in the case of telescope operation in Cambridge (USA), with Site Code "b" when the telescope was moved to Harvard–Boyden Station in Arequipa (Peru), with "c" - for the time period of operation of the instrument in Harvard-Chuquicamata Station (Chile), with "d" - in Harvard-San Jose Station (Peru), and with "e" - in Harvard–Boyden Station in Bloemfontein (South Africa);

- Certain plate archive made with one certain instrument and stored in one certain observatory/institution but by different astronomers in charge, e.g. the plate archives having Instrument identifier "NAV155" are coded as Side Code "1" for 1650 plates stored in Washington DC (USA) by C. Dahn, and Side Code "2" for 50000 plates taken in the period 1976-1996 for which astronomer in charge is B. Mason.

Below are listed the changes made in the CWFPAs version 7.0. The mentioned archives were "separate archives" only because the difference in the time interval of plate obtaining. Now in the last CWFPAs version the "separate archives" are unified:

1) **Version 7.0 of CWFPAs:** CAT033 archive.

Previous CWFPAs versions: There were three CAT033 sub-archives in dependence of the time interval:

Period	Number of Obtained Plates
1894-1932	1600
1956-1964	100
1985-1992	100

2) **Version 7.0 of CWFPAs:** HAR020A archive made when the telescope operated in Harvard Observatory (Observatory code: 802).

Previous CWFPAs versions: There were three HAR020A sub-archives in dependence of the time interval:

Period	Number of Obtained Plates	Plate Serial Number
1885-1888	3186	1-3186
1906-1907	16	37264-37280
1914-1915	86	45182-45268

3) **Version 7.0 of CWFPAs:** HAR020A archive made when the telescope had been moved to Harvard–Boyden Station in Arequipa (Peru) with Observatory Code: 800.

Previous CWFPAs versions: There were three HAR020A sub-archives in dependence of the time interval:

Period	Number of Obtained Plates	Plate Serial Number
1891-1905	31417	5846-37263
1907-1914	7900	37281-45181
1915-1923	8485	45269-53754

4) **Version 7.0 of CWFPAs:** HAR020A archive made when the telescope had been moved to Harvard–Boyden Station in Bloemfontein (South Africa) with Observatory Code: 74.

Previous CWFPAs versions: There were two sub-archives as follows:

Period	Number of Obtained Plates	Plate Serial Number
1930-1954	23109	53755-76864
1959-1959	314	

5) **Version 7.0 of CWFPA's:** HAR020B archive made when the telescope had operated in Harvard Observatory (Observatory code: 802).

Previous CWFPA's versions: There were two sub-archives:

Period	Number of Obtained Plates
1889-1934	52663
1934-1946	6423

(6) **Version 7.0 of CWFPA's:** HAR025 archive made when the telescope operated in Harvard–Boyden Station in Arequipa (Peru) with Observatory Code: 800.

Previous CWFPA's versions: There were two sub-archives:

Period	Number of Obtained Plates	Plate Serial Number
1918-1923	5705	2514-8219
1924-1924	558	8419-8973
1925-1925	929	8993-9922

(7) **Version 7.0 of CWFPA's:** HAR081 archive made when the telescope operated in Harvard–Boyden Station in Bloemfontein (South Africa) with Observatory Code: 74.

Previous CWFPA's versions: There were two sub-archives:

Period	Number of Obtained Plates
1950-1955	2100
1956-1963	3898

(8) **Version 7.0 of CWFPA's:** LOW012A archive made when the telescope operated in Lowell Observatory, Flagstaff (USA) with Observatory Code: 690.

Previous CWFPA's versions: There were two sub-archives:

Period	Number of Obtained Plates
1905-1907	100
1911-1916	1100

2.4 IMPORT OF CWFPA's TO THE ONLINE SYSTEM

The import of the new upgraded version of the CWFPA's is done via a custom tool to the Database Management System (DBMS). The representation of the CWFPA's in the online system comprises:

- The list of all WFPDB archives (<http://wfpdb.org/search/search.cgi?service=listofarchives&type=all>).
- The list of archives with (at least some) plates already included in the WFPDB (<http://wfpdb.org/search/search.cgi?service=listofarchives&type=active>).
- Details for an individual archive (available via links).

3. RECENT DEVELOPMENT IN THE WFPDB ONLINE ACCESS SYSTEM

The recent development in the WFPDB online access system includes the interoperability with AstroWeb – an application which presents graphically the data of the CWFPAs, as well as ensures fast and easy access to the digitalized plate information (Kolev et al. 2012). AstroWeb uses the same exact data-set as the WFPDB search system.

Another development is the Time Histogram of Observations (for the period of observations) for every plate archive included in the WFPDB (built on-the-fly) and presented in Fig. 4.

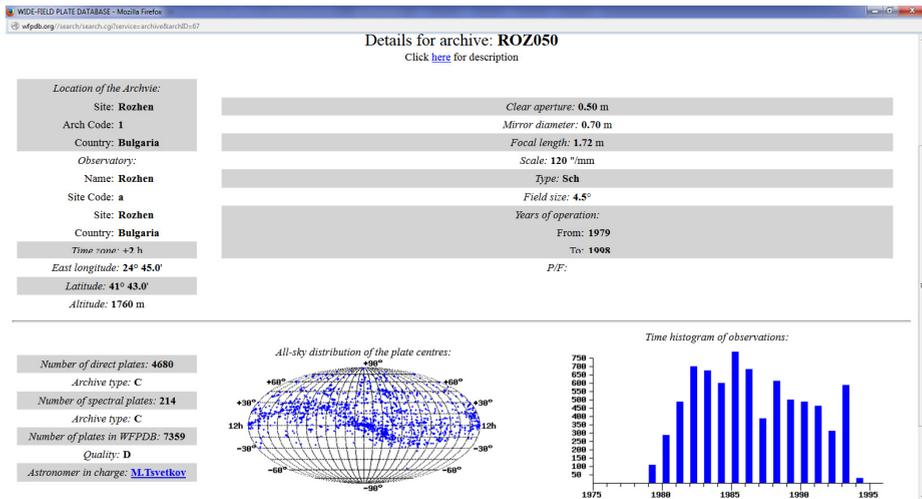


Figure 4: Details for archive ROZ050 including the time histogram of observations, which can be found in the WFPDB site.

References

- Kolev, A., Tsvetkov, M., Dimov, D., Kalaglarsky, D.: 2012, *Serdica J. Computing* **6**, 89–100.
- Tsvetkov, M. K., Stavrev, K. Y., Tsvetkova, K. P., Mutafov, A. S., Semkov, E. H.: 1997, Standardized description of the catalogue ReadMe (<http://cdsarc.u-strasbg.fr/viz-bin/Cat?VI/90>).
- Tsvetkov, M.: 2006, Wide-Field Plate Database: a Decade of Development, In: Virtual Observatory: Plate Content Digitization, Archive Mining and Image Sequence Processing, iAstro workshop, Sofia, Bulgaria, Eds. M. Tsvetkov, F. Murtagh, R. Molina.
- Tsvetkova, K., Tsvetkov, M.: 2006, In: Virtual Observatory, Plate Content Digitization, Archive Mining, Image Sequence Processing, Eds. M. Tsvetkov, V. Golev, F. Murtagh, R. Molina, Heron Press Science Series, Sofia, 45-53.
- Tsvetkova, K., Tsvetkov, M.: 2008, VizieR Online Data Catalog: VI/126.

Tsvetkova, K., Tsvetkov, M.: 2013, Proceedings of VIII BSAC, Leskovac, Serbia, May 8-12, 2012, Eds. M. S. Dimitrijević and M. K. Tsvetkov, *Publ. Astron. Soc. "Rudjer Bošković"*, **12**, 349-357.